INDUSTRIAL DESIGN

10 PRODUCT PLANNING PRODUCT DESIGN PACKAGING MARKETING

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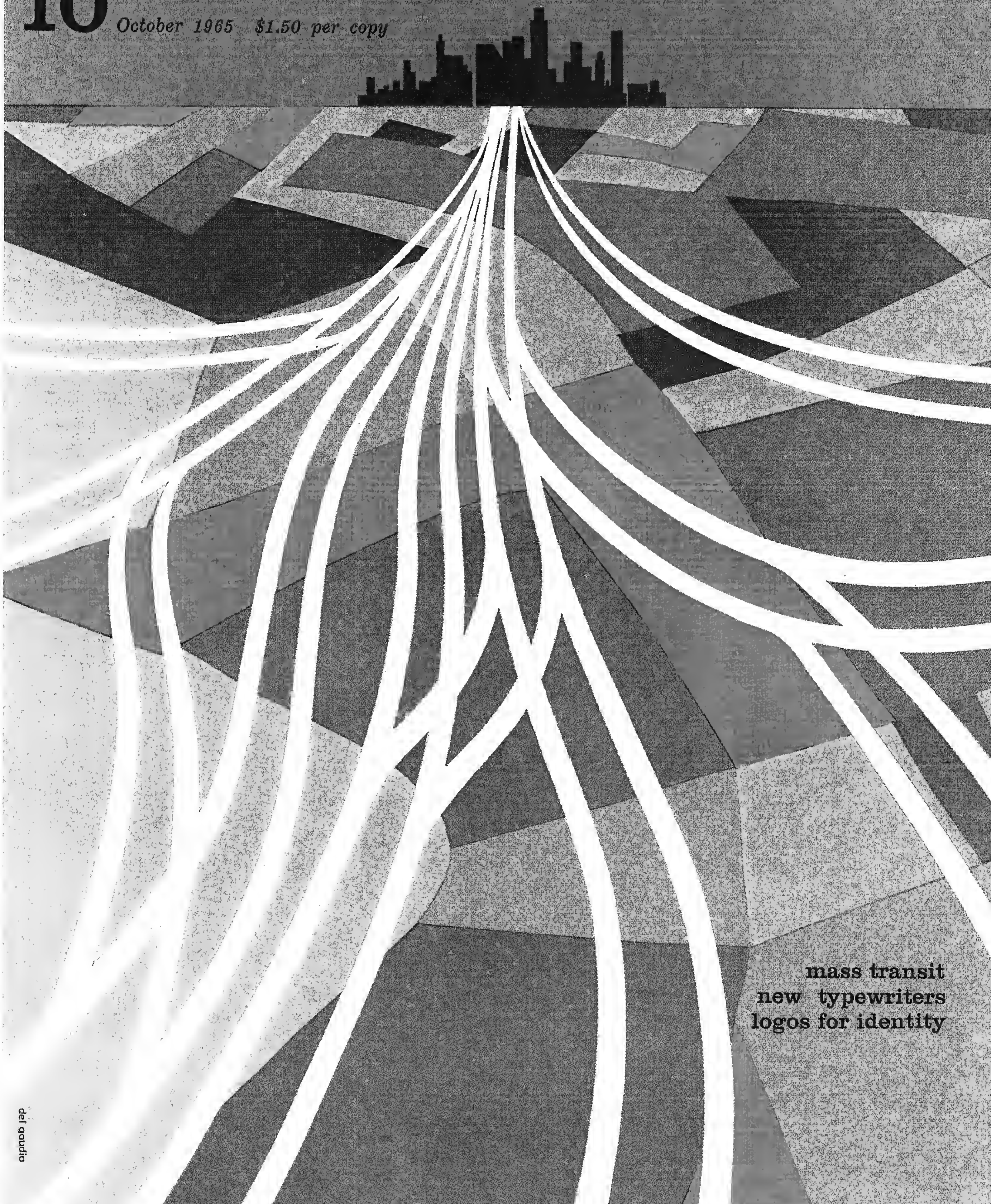

Industrial design is playing a major role in the building of this country's first totally new mass transit system since 1907.

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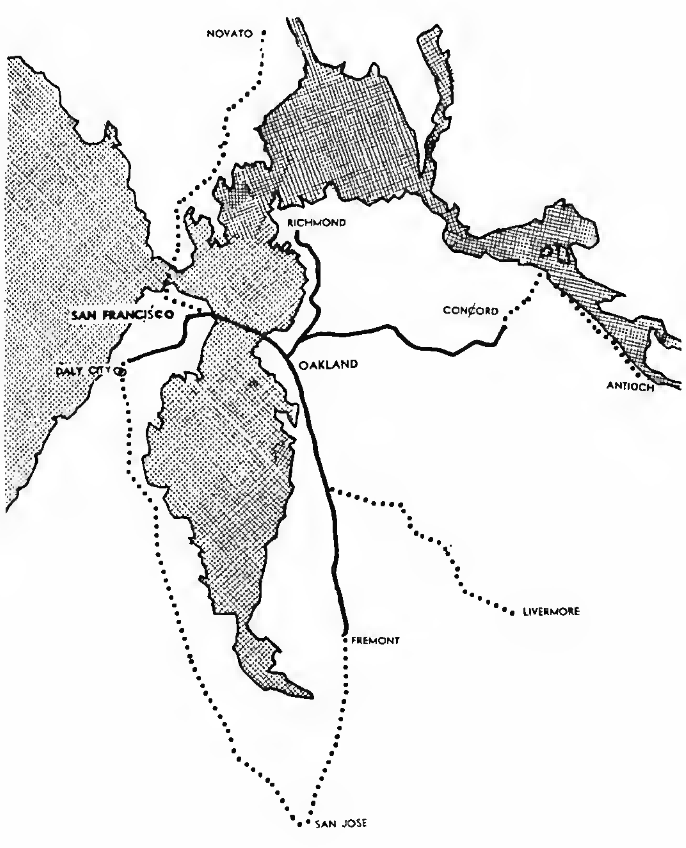
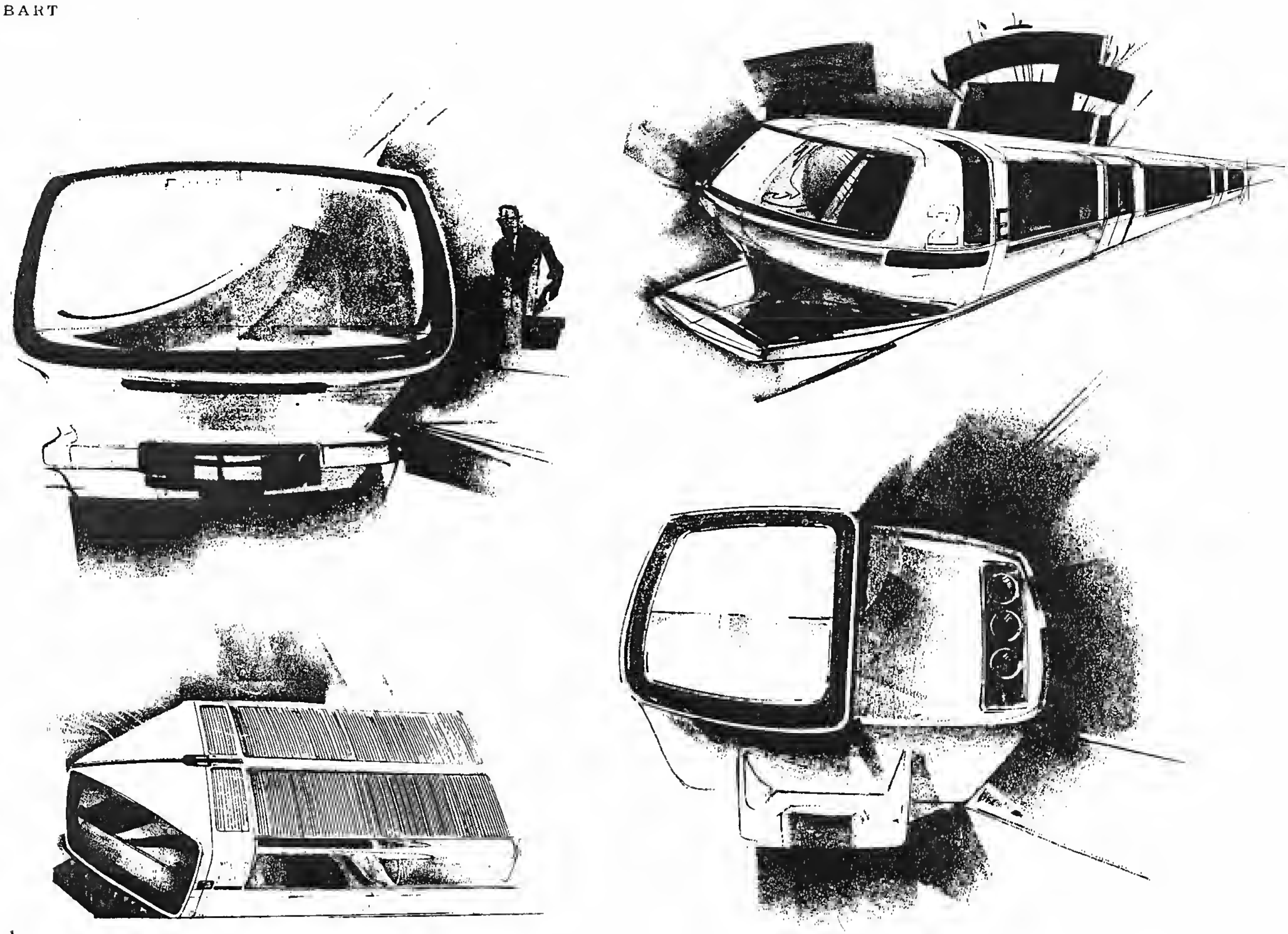
BY PATRICIA L. CONWAY



If every one of the nearly 1.5 million motor vehicles registered in the San Francisco Bay Area were lined up bumper to bumper, the line would stretch from California to Maine. To avoid being strangled in a permanent traffic jam—a problem now threatening every major city in the United States—the Bay Area Rapid Transit District (BART) is investing $1 billion in a rapid mass transit system scheduled for completion in 1971. The BART system will incorporate the latest developments in roadbed engineering, track construction, and automated control, but its success depends almost entirely on creature comforts—environmental factors designed to lure 200,000 Bay Area commuters a day out of their cars and into BART's trains. To compete effectively, the trains must be faster, safer, and above all, more comfortable and attractive than the growing number of private cars thronging already congested superhighways.

In an unprecedented concession to comfort and aesthetics in mass transit planning, BART called in an industrial design firm at the outset of its development program. Sundberg-Ferar, working with St. Louis Car, was given a contract to build a $250,000 prototype car (now completed and on display to the public in the Bay Area), and maintain continuing



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supervision on all future manufacture of the car. To round out the project, Sundberg-Ferar has also been retained to design BART's graphics and all station hardware, including ticket booths, vending machines, and a package for the automatic fare collection system now under study. (The stations themselves are being individually designed by local architects, and plans for 29 of the 37 are already underway.) According to Sundberg-Ferar president Carl Sundberg, the BART contract represents "probably the largest, most extensive, and most completely detailed hardware project ever undertaken by an industrial design firm."

But the impact of industrial design on mass transit thinking may well be felt beyond the Bay Area. Unlike those cities which are hamstrung in their mass transit planning by outdated and inefficient systems already in existence, San Francisco enjoys the advantage—and the challenge—of being able to start from scratch. To make sure that this country's first modern transit system gets thorough study before any construction begins, the U.S. Housing and Home Finance Agency has granted BART $7,352,666 for exhaustive research and development programs. (This is in addition to the $1 billion for actual construction costs, most of which is coming from bond issues voted by Bay Area residents.)

For each major piece of equipment involved in the highly complex system, as many as four or five manufacturers have been awarded prototype contracts. For example, Budd, General Steel, Latourneau-Westinghouse, LFM-Atchison, and Pullman-Standard have each designed a four-wheel lightweight truck. One, or a combination of several of these prototypes, will be selected by BART for final production. In many instances, manufacturers have actually donated time and materials to the project (Alcoa supplied aluminum extrusions and sheathing for the prototype car; American Seating supplied the seats). When the prototypes are completed and BART makes its decisions, it is hoped that all of the hardware will add up to the most attractive, efficient, and technically advanced rapid mass transity system in the world.

If it does, BART will be quite a feather in the civic cap of San Francisco. But the federal government, for one, expects more than just a local return on its investment. It is hoping that BART will become an inspiration and a prototype for other cities in need of new or improved mass transportation. For Sundberg-Ferar, this means that even if they never design

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1-5. From hundreds of roughly sketched ideas, 1, Sundberg-Ferar developed several cars into 1/12 scale models, 2-4, and then into ¼ scale models. Having arrived at an approximate configuration for the final car, the designers presented to BART a 1/12 scale model of a multi-car train, 5.

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another transit car, future mass transit systems everywhere will likely bear the stamp of their BART car. For the design profession as a whole, it means that the public, once exposed to the comfort and convenience of the BART system, may begin to demand well designed rapid transit in all major cities.

Luxury on wheels

Following BART's policy of seeking out the best possible solution to all the major problems posed by rapid transit design, Sundberg-Ferar developed its final prototype car only after exploring many possible approaches. The most radical suggestions were usually rejected ("A train that has a maximum speed of 80 mph shouldn't look like a bullet," says Sundberg-Ferar vice president Montgomery Ferar) and the final design, while fleet and sophisticated, has a solid, practical look.

The exterior of the prototype is natural-finish aluminum with a painted blue accent stripe. The final decision on production materials has not yet been made, however, and stainless steel is still very much in the running. The dimensions of the car, dictated by BART and Parsons-Brinkerhoff-Tudor-Bechtel, the joint venture engineering firm overseeing the project, are: length, 70 feet; height, 10 feet 6 inches; maximum width, 10 feet 6 inches. A wider-than-normal track gauge of 5 feet 6 inches (standard two-rail track in this country is 4 feet 8½ inches) permits a wider, lower silhouette crisply angled to give more interior hip and elbow room. It also insures a more stable ride in BART's relatively lightweight cars, which will be subjected to high cross-winds prevailing in the Bay Area. For the first time in this country, continuously welded steel rail is being used to improve noise and vibration characteristics. The wheels, also, will most likely be steel, although rubber tires were at one time being considered.

The interior of the prototype car is faced with molded fiber glass panels in a buff color, accented with brightly colored trim. Wood grain vinyl panelling on the wind screens visually separates the entrance/exit areas from the rest of the car. The ceiling is a molded fiber glass pan with openings for lighting and speaker units. Adjacent to the doors, wall space is provided for a directional map. Because there is no allowance for advertising in the prototype car, white-on-beige line murals of historic Bay Area landmarks have been suggested to add visual interest

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to the interior space. (Advertising has not yet been ruled out, however; one plan now under study is a screen-and-projector system.)

There are no ash trays in the BART car (smoking in public conveyances is against the law in San Francisco) and no provision for refreshments (the trip for most commuters will be too short). But BART's riders may be treated to a "first" in rapid transit luxury—wall-to-wall carpeting. San Francisco's mild climate makes carpeted floors much more practical than they would be in a city like New York, and BART is considering vibrating pads for the station floors to cut down on dirt and moisture tracked into the train. Ordinary wool carpet is now installed in the prototype, but Gulistan is weaving a special Herculon polypropylene carpet for BART in a quiet beige-on-beige pattern. Sundberg-Ferar recommended the carpeting because it cuts down on noise, adds to the comfort of the car, is claimed to be as tough as conventional floor tile, and can be economically maintained (although a specially designed vacuum apparatus may be needed to clean around seating supports).

Large window areas glazed in heat-shielding tinted glass will give BART riders a panoramic view of the Bay Area landscape. Wind screens are positioned adjacent to the door openings, and the doors themselves, like just about everything else in the train, will be operated automatically. Car-to-car passage areas are enclosed in an accordian-pleated weatherproof structure so that commuters can move easily to less crowded cars in the train. Bi-parting doors connecting the cars will be passenger-operated by a treadle or push button.

Seats for everyone

With trains automatically timed to arrive at stations every 90 seconds during rush hours, BART is guaranteeing everyone of its passengers a seat. Consequently, Sundberg-Ferar has designed the interior specifically for the seated passenger. A conspicuous absence of bars, straps, and handles to support standing passengers increases the feeling of spaciousness within the car, and insures unimpeded traffic flow. After examining the possibilities of lounge-type arrangements, swivel chairs, and flip-back reversible seating, the designers settled on a straight-forward layout of 72 permanently positioned seats grouped transversely by twos and fours. The aisles are a wide 30 inches, with seats adjacent to the doors placed

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laterally to increase space in the entrance/exit areas. Spacing between seats is gauged to permit access to and from window seats without disturbance to passengers seated on the aisle.

The seats, designed by Sundberg-Ferar and built by American Seating, measure 44 inches across—a good 4 inches wider than conventional mass transit seating. This additional width is accommodated without sacrifice of aisle space by the angled cross-section of the car body. Because BART feels that upholstered seating is essential in a mass transit system intended to compete with the private automobile, Sundberg-Ferar has designed the seats "for comfort, not for

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6, 7. Lighting, air conditioning, and dimensional studies were conducted in a full-size mock-up of a section of the car. On the wall are suggested seating plans and just a few of the early car sketches.

8, 9. The prototype was built in Sundberg-Ferar's model shop.

10. Upon completion, the prototype was trucked from Detroit to San Francisco, where it is now on display.

11. The accordian-pleated coupling closure is recessed within the frame of the car so that when it is in the depressed position, a control pod can easily be fitted over it.

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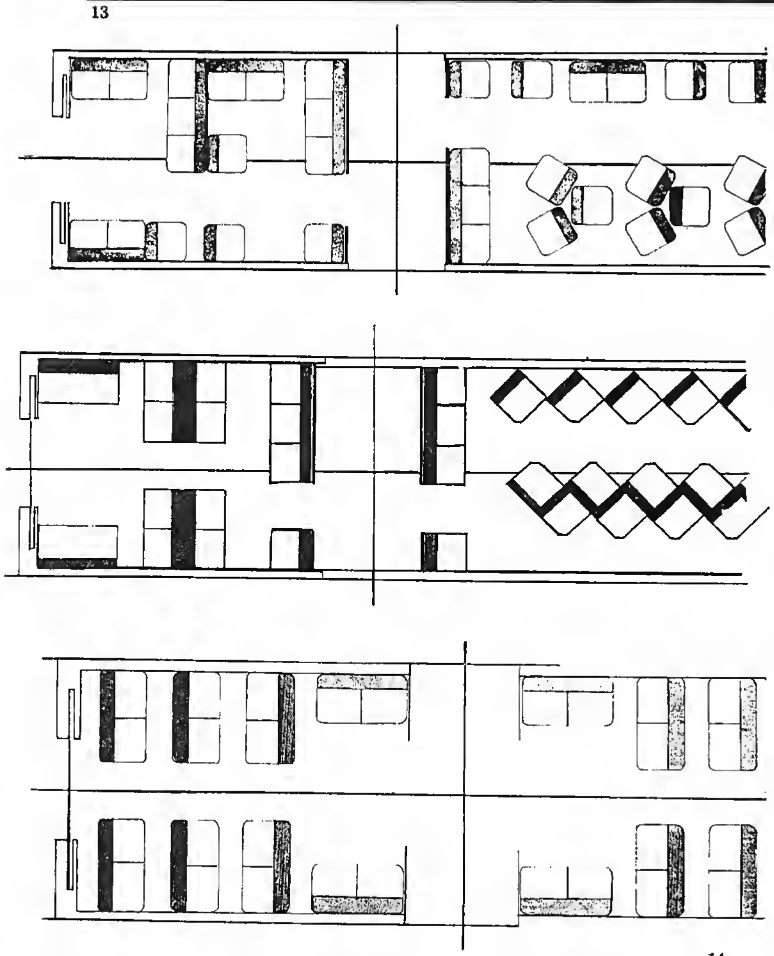

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13-15. The prototype interior presents a spacious, uncluttered appearance. Several seating arrangements were considered before the final layout was chosen (at bottom, **14**).

16. Lighting fixtures are flush-mounted on the ceiling, over the seats and parallel to them. Specially designed reflectors split the light from each fixture into two separate beams, one aimed forward, the other back. The separate beams create ambient light throughout the car, but at that point where two beams from adjacent fixtures meet, higher intensity light is produced. This union of beams occurs approximately 30 inches from the floor, or at standard reading level. The reading light is focused just forward of the chest of each seated passenger, missing both his face and the head of the passenger ahead of him. Lenses are designed so that light cannot leak out at an angle greater than 45° from downward projection, thus preventing light from striking the eyes of passengers seated across the aisle or to the rear of a particular fixture. All hardware inside the fixture is concealed by the lens action. In entrance/exit areas, ambient lighting is increased to meet safety requirements and direct passengers' attention toward the doors.

17. In accordance with the venturi principle—that air forced through a tube at high velocity causes a drop in surrounding air pressure which, in turn, sucks in more air—cool air is injected into the car at floor level. The drop in pressure sucks in non-cooled air at a ratio of 1-to-1, and this mixture is delivered at the side of the window. It is then circulated up along the window, across the ceiling, and back down into the return duct. Thermostats located in the car roof control the air conditioning system, and all equipment is located under the car rather than above it. This permits a lower, sleeker car silhouette, and cuts tunneling costs by reducing the necessary tunnel height.

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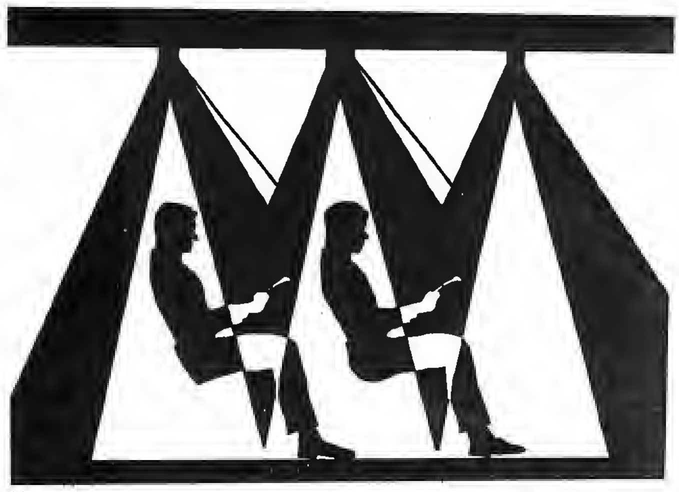

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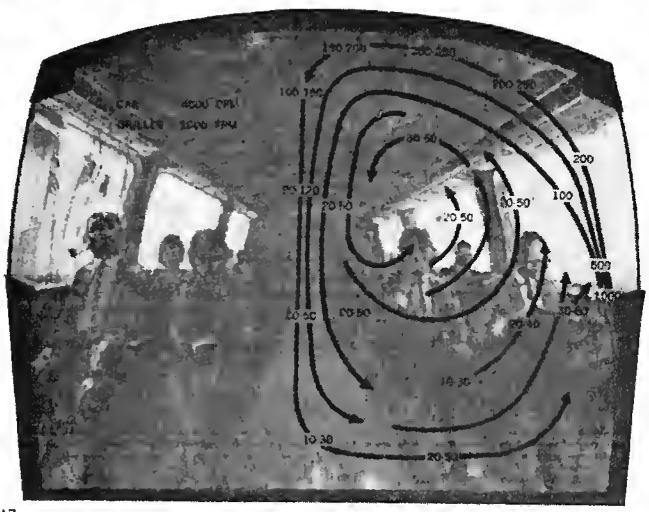

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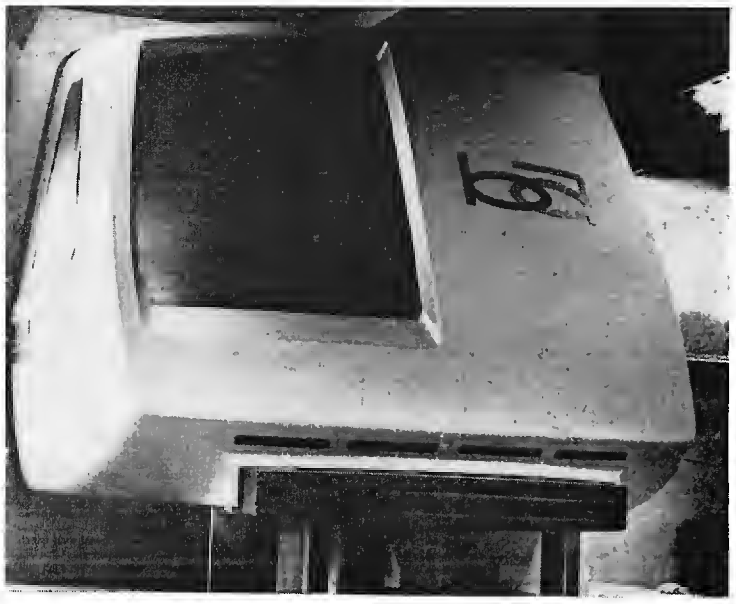
vandalism," as one designer puts it. Actually, San Francisco is not plagued with vandalism to the degree that certain other large cities are, but should the problem arise, the seats can be easily replaced.

Framed and supported with steel, the seats are padded with foam rubber over non-sagging steel springs. (Cantilevered seats were rejected because of strength and aesthetic considerations.) The covering of the seats is a woven vinyl, with solid Dura-Leather vinyl side panels. Throughout the car, the transversely positioned seats are a charcoal grey, while those placed laterally are a russet color to orient passengers toward the exit areas. A grip bar is neatly recessed within the seat profile.

Once seated, BART's riders will enjoy the most comfortable lighting and air conditioning ever designed for a mass transit vehicle. Departing from the ordinary concept of strip lighting, Sundberg-Ferar and the Grimes Manufacturing Company have developed a dual lighting system which combines soft, low-level lighting throughout the car with higher intensity light focused in the reading plane, or that area just forward of the chest of each seated passenger. The air conditioning system, developed by Vapor Heating Corporation and based, in part, on Airesearch Manufacturing Company's study of air comfort requirements in the Bay Area, is the first of its type to be used in a mass transit vehicle. It utilizes the venturi principle (see **17**), which moves twice the amount of air circulated by a conventional system, and avoids the problem of cold air blasts along the window.

Detachable control pod

Although BART's electrically-powered trains will be controlled almost entirely from a central bank of computers, a certain amount of on-board control equipment is necessary. To eliminate redundant installations of this equipment in every car, and thus reduce the investment in control apparatus, Sundberg-Ferar has designed a detachable pod without wheels which houses all on-board controls. Two of these pods will be attached to each 10-car train, one at either end. (BART's lines are essentially shuttles; there are no loops.) Inside the pods, manual override controls, an emergency stop button, and switches for manual operation of the doors, air conditioning system, horn, etc., are located on a control panel. An attendant, stationed in the pod primarily to reassure BART's riders, will have little to do other than keep written records, announce stations over a



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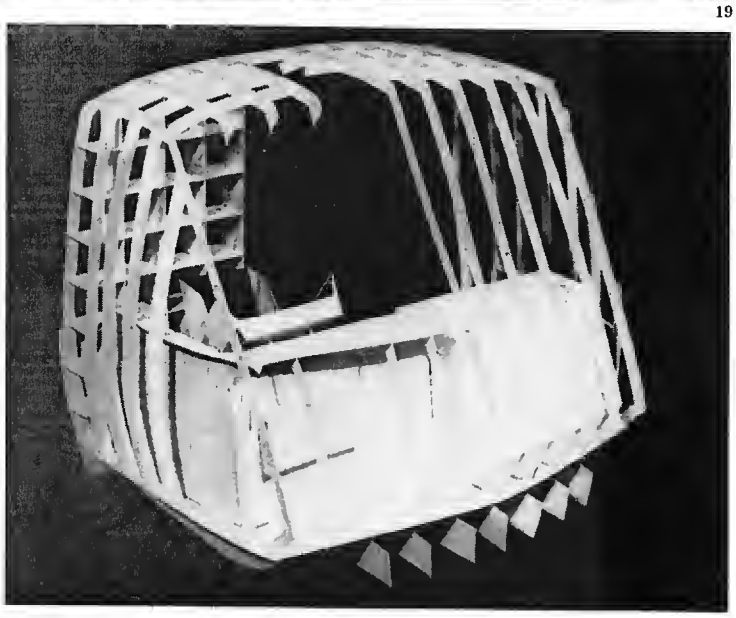

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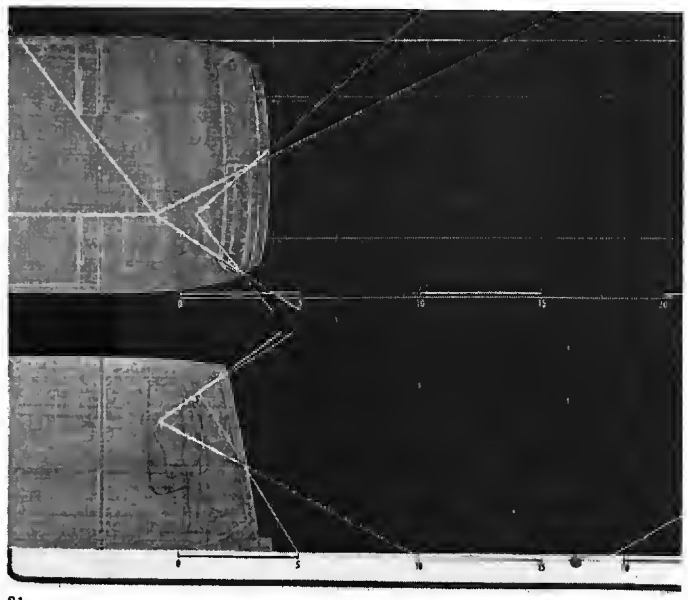

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19. A full-size wooden plug was used to make the mold over which the fiber glass control pod was layed up.

20. Space studies for the attendant's work area and electronic component housing were conducted with the aid of a 1/12 scale skeleton model of the control pod.

21. Sight line charts were used to determine the attendant's range of vision relative to track curves, signals, and on-board controls housed in the pool.

PA system, and halt the train in case of emergency. By manually stopping his own train, the attendant will bring to a halt every other train on that particular line. Once the line is halted, the attendant will be able to operate his train with manual override controls until automatic control is restored.

The body of the prototype pod is molded of fiber glass reinforced plastic. Compound curves in the pod housing dictate the use of fiber glass for economic reasons, and as in the interior panelling, fiber glass has enabled the designers to achieve a smooth, sculptured look with a minimum of joints and fastenings. The rear of the pod, which is cantilevered out from the car to which it is attached, fits over the collapsible pleated coupling closure at either end of each car.

Because they have neither wheels nor a power supply, the pods will require special road hostling equipment to move them about the switching yards. For the cars themselves, Sundberg-Ferar has designed a small plug-in hostling device with which an attendant can maneuver the cars when they are detached from the pods.

Assuming that the automatic control system will be able to stop trains within a one-foot tolerance—a fairly remarkable feat—BART is designing each of its stations with provision for a screen wall to separate waiting passengers from the track and oncoming trains. If feasible, the system will operate rather like a horizontal elevator, with doors in the screen wall positioned to coincide exactly with the doors on the train. The advantages of such a system are obvious: greater safety and comfort for waiting passengers, less noise in the stations, and automatic orientation of boarding passengers to the door areas. A special suspension systems may also be incorporated in the trucks to level car floors exactly with station platforms.

Many of the innovations in the BART car—the carpeting, particularly—will undergo severe performance testing while the prototype is on display in the Bay Area this month. Questionnaires are being distributed to gauge public reaction to the car, but any changes in the design before final production will be based on further study. Nevertheless, the public is footing the bill—both in the bond issues and in a graduated fare scale—and public enthusiasm for the project is essential to its success. Good industrial design is going a long way toward arousing this enthusiasm, and toward making the name "BART" synonomous with modern mass transit in this country.

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22. The control pod houses all on-board electronic components at left. Concealed storage' areas accommodate tools, a first aid kit, and the attendant's work area at right.. All exposed work surfaces have been eliminated for reasons of safety and appearance.

23. Carl Sundberg displays the small plug-in hostling device used to maneuver cars when they are detached from the control pod.

24. The control panel reads from right to left in order of functional importance. The emergency stop button at top, right, is designed so that it cannot be depressed accidentally.